

## Passaic River RARC Reference and Background Definitions and Usage Document

The purpose of this document is to (i) define the terms reference information and background data for use during the 17-mile Remedial Investigation/Feasibility Study being conducted for the Lower Passaic River Study Area as part of the Diamond Alkali Superfund site, (ii) outline how this information and data should be used in the ecological risk assessment, and (iii) select the specific reference and background locations that should be used.

### Reference

Ecological risk assessments at Superfund sites estimate the adverse effects of chemical contaminants on the plant and animal life inhabiting the area associated with the site. This process depends on the collection of data from the impacted areas of the Superfund site; however, these data alone often cannot show whether adverse ecological effects have already occurred, or might still occur, as a result of site contamination. Therefore, to evaluate actual impacts or likely ecological risks more completely, site data are typically compared to data that represent reasonable expectations for the site. These data are commonly referred to as reference information (USEPA 1994).

Reference information is needed by investigators for evaluation or comparison with environmental conditions at a Superfund site. Reference data are baseline values or characteristics. Reference information generally falls into one or more of the following categories: relevant existing data, models or reference samples. Relevant existing data may be specific to the site-associated area collected before contamination occurred or data from elsewhere that can be applied to site conditions. Models generally consist of indices and similar mathematical simulations of relationships among habitats, populations and communities. Reference samples are new data collected from the least impacted area of the Superfund site or from a nearby site that is ecologically similar to the Superfund site and is not affected by the Superfund site contaminants. Although all three sources of reference information are used in ecological risk assessments, knowledge of exact pre-contamination conditions or finding a reference site that exactly reproduces pre-contamination status is not possible in the majority of cases (USEPA 1994).

Most often, sampling for new data is the best approach to establishing reference conditions. Depending upon the circumstances, reference samples are collected on-site (or from the site-associated area) or from a separate location, known as a reference site. On-site reference samples should, ideally, be collected from the unaffected portions of contaminated habitats. More commonly, on-site samples are taken along a gradient from lowest to highest contaminant concentration. The area of lowest impact or lowest measured concentration becomes the "reference" target for the site. This type of "reference" information can become necessary when all habitats are affected to some extent by site contaminants. Reference samples may also be collected from a reference site<sup>1</sup>. Reference sites should match the

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<sup>1</sup> EPA defines reference areas as "a relatively uncontaminated site used for comparison to contaminated sites in environmental monitoring studies (EPA 1997) and NJDEP defines reference areas as "a habitat similar to the habitat being assessed but which is not contaminated. The reference area may or may not be within the background area."

Superfund site, to the extent practicable, in all aspects except contamination. Reference sites are typically located upstream, upwind or higher in the drainage system, but otherwise as close as possible to the Superfund site. It is also important to ensure that the ranges of animals under study at reference locations do not overlap the area affected by the Superfund contaminants. Where probability of such overlap is unavoidable, it is necessary to use reference areas at greater distances from the Superfund site or to shift the focus of the investigation to organisms with more restricted ranges.

## Background

Background is defined in USEPA 2002 as “Substances or locations that are not influenced by the release from a site and are usually described as naturally occurring or anthropogenic: (1) Naturally occurring substances are present in the environment in forms that have not been influenced by human activity, (2) Anthropogenic substances are natural and human-made substances present in the environment as a result of human activities (not specifically related to the CERCLA site in question).” Further the document describes background references areas as “The area where background samples are collected for comparison with samples collected on site. The reference area should have the same physical, chemical, geological, and biological characteristics as the site being investigated, but has not been affected by the activities on the site.” Similar definitions are identified in NJDEP’s ecological risk assessment guidance<sup>2</sup>. All of the definitions identify background as concentrations of contaminants in environmental media. Therefore, for the purposes of the Baseline Ecological Risk Assessment, background will refer to the concentrations of contaminants that are found in the surface water, sediment and tissue collected from background locations.

## Descriptive Terms

Additional characteristics may be used to describe the area from which the data was collected for reference information or background concentrations for each data use. These descriptions can include, but are not limited to, freshwater, estuarine, marine, urban, industrial, non-industrial and rural. These terms describe the characteristics of the data set and not the data set itself. For example, a data set that contains information on typical sediment concentrations from an industrially influenced area would be termed “background from an industrial area” as opposed to “industrial background.”

## Usage

The preferred use of reference and background information is to compile data from representative locations (i.e., same or similar physical, chemical, geological, and biological characteristics, but not affected by the activities on the site) to develop a range of values that can be used for comparison to

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<sup>2</sup> “Background Area” means a habitat similar to the habitat being assessed, but one that is outside of the influence of the site discharge (NJDEP 2012). “Background Contamination” means representative contaminant levels in the immediate area of the site that are not attributable to the site discharge itself and that originated from either natural sources (not man-made) or offsite discharges (man-made, discharges not related to the site). These background contaminant concentrations are generally derived by collecting samples in the background area, avoiding hot spots (NJDEP 2012).

the data collected from within the study area. The primary use of the reference information and background concentrations will be to evaluate risk management options.

The reference information will support and be utilized to build a “weight-of-evidence” which shows a causal link between the contamination and observed effects. Reference information is corroborative by definition, and reference samples, along with site samples, are used to develop relationships that may be statistically based to determine whether the contaminants are most likely related to any observed impacts. Given that perfect reference sites do not exist, professional judgment is the key to proper selection and use of reference information. This is the most important reason for gathering reference data from a broad range of categories, as described in EPA 1994, for use in the baseline ecological risk assessment, which in turn will allow for a robust evaluation in risk management decisions.

The use of reference information and background concentrations will be used qualitatively in the Baseline Ecological Risk Assessment for comparison purposes to explain observations in the collected data. The use of reference information and background concentrations will not be used to negate the calculated quantitative risk estimates or subtracted from the calculated site risk estimates. The following table presents the use of reference information and background concentrations as they pertain to the identified measurement endpoints. The specific language for each assessment endpoint can be found in Table 2-1 from RARC Appendix B.

Table 1. Uses of Reference and Background Data

Assessment Endpoint	Data Type	Reference information or Background Concentration
AE1: Maintenance of zooplankton communities...	Surface water chemistry	Background concentration from each area
AE2: Protection and maintenance of benthic invertebrate community...	Benthic invertebrate community structure	Reference information from each area
	Surface sediment chemistry	Background concentration from each area
	Benthic invertebrate toxicity tests	Control data and reference information from each area
	Surface water chemistry	Background concentration from each area
AE3: Protection and maintenance of health population of blue crab and crayfish...	Whole-body tissue chemistry	Background concentrations from each area
	Surface sediment chemistry	Background concentration from each area
	Surface water chemistry	Background concentration from each area
AE4: Protection and maintenance of healthy mollusk population	Tissue chemistry	Background concentration from each area
	Surface sediment chemistry	Background concentration from each area

	Surface water chemistry	Background concentration from each area
AE5: Protection and maintenance of fish populations..	Fish tissue chemistry	Background concentration from each area
	Internal/external health observations	Reference information from each area
	Fish/invertebrate/surface sediment chemistry	Background concentration from each area
	Surface water chemistry	Background concentration from each area
AE6: Protection and maintenance of bird populations	Fish/invertebrate/surface sediment/surface water chemistry	Background concentration from each area in Table 2
AE7: Protection and maintenance of aquatic mammal populations	Fish/invertebrate/surface sediment/surface water chemistry	Background concentration from each area in Table 2
AE8: Maintenance of healthy aquatic plant populations..	Surface sediment chemistry	Background concentration from each area
AE9: Protection and maintenance of healthy amphibian and reptile populations	Surface water chemistry	Background concentration from each area

Based on USEPA 1994, the five characteristics that have been determined to be of greatest importance in selecting background and reference information for use in the Baseline Ecological Risk Assessment for the Lower Passaic River Study Area are contamination, water type, habitat, community structure and distance from study area. Three areas have been selected for use as potential background and reference locations. These areas include the Passaic River above Dundee Dam, Jamaica Bay and the Mullica River (see Table 2). Although Jamaica Bay and the Mullica River are not directly connected to the site, they represent a range of environmental conditions that overlap with conditions within the LPRSA. These selected areas provide a broad range of data sets that can be used to qualitatively discuss the risks and hazards that are calculated for the LPRSA, in the risk management phase.

Note that data sets that are used for reference and background comparisons should undergo a statistical outlier test to ensure that the data is not skewed. In addition, if EPA determines that the results of the toxicity tests, the benthic community survey and/or the fish health survey (i.e., the three measurement endpoints that utilize reference data) from the area above Dundee Dam indicate that it is not a suitable reference area, then collection of data from other sources, such as the Passaic River above the confluence of the Pompton River, will be considered.

Table 2. Reference and Background Locations

Location	Contamination	Water	Habitat	Distance	Parameter
Passaic River above Dundee Dam and head of tide	Low to medium	FW	Urban	Close	Fresh Water Contaminants
Jamaica Bay	Low to medium	Estuarine	Urban	Nearby	Estuarine Contaminants
Mullica River	Low	Estuarine/ Fresh Water	Rural	Distant	Estuarine/ Fresh Water Contaminants

#### References

NJDEP. 2012. Ecological Evaluation Technical Guidance

[http://www.nj.gov/dep/srp/guidance/srra/ecological\\_evaluation.pdf](http://www.nj.gov/dep/srp/guidance/srra/ecological_evaluation.pdf)

USEPA. 1992. Guidance for Performing Site Inspections Under CERCLA . OWSER Directive 9345.1-05. Office of Solid Waste and Emergency Response, Washington DC.

<http://www.epa.gov/superfund/sites/npl/hrsres/si/siguidance.pdf>

USEPA. 1994. Eco Update. Selecting and Using Reference Information in Superfund Ecological Risk Assessments. EPA 540-F-94-050. Office of Solid Waste and Emergency Response, Washington DC.

<http://www.epa.gov/oswer/riskassessment/ecoup/pdf/v2no4.pdf>

USEPA. 1997. Interim Final, Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Office of Solid Waste and Emergency Response . EPA 540/R-97/006. Office of Solid Waste and Emergency Response, Washington DC

<http://www.epa.gov/oswer/riskassessment/ecorisk/ecorisk.htm>

USEPA. 2002. Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites. EPA 540-R-01-003. Office of Emergency and Remedial Response, Washington DC.

<http://www.epa.gov/oswer/riskassessment/pdf/background.pdf>